

Updated Informative Digest

Proposed Amendments to the Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear

Sections Affected: Proposed amendment to title 17, California Code of Regulations, section(s) 95350, 95351, 95352, 95353, 95354, 95355, 95356, 95357, 95358, and 95359. Proposed adoption of title 17, California Code of Regulations, sections 95354.1, 95357.1, 95357.2, and 95359.1.

Documents Incorporated by Reference (Cal. Code Regs., tit. 1, § 20, subd. (c)(3)):

United States Environmental Protection Agency. 2014. Mandatory Reporting of Greenhouse Gases; Final Rule. Title 40 Code of Federal Regulations, Part 98, Subpart A, Table A-1. December 11, 2014.

<https://www.govinfo.gov/content/pkg/FR-2014-12-11/pdf/2014-28444.pdf>

Section 95351(a).

Background and Effect of the Proposed Regulatory Action

CARB staff is proposing amendments to the Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear (Regulation, title 17, California Code of Regulations, sections 95350 et. seq.). The Regulation was originally enacted as an early action measure pursuant to the California Global Warming Solutions Act of 2006 (Assembly Bill 32 or AB 32; Chapter 488, Statutes of 2006) to reduce SF₆ emissions from the electricity sector's transmission and distribution system. AB 32 established an initial goal for California to reduce statewide greenhouse gas (GHG) emissions to 1990 levels by 2020 and to maintain and continue GHG emissions reductions beyond 2020. The current Regulation requires owners of gas-insulated switchgear (GIS) to report the following annually: SF₆ emissions, an inventory of their GIS that use SF₆ as an insulating gas, information related to containers that store SF₆ gas, and transfers of SF₆ into or out of GIS. The proposed amendments would also change the term "GIS" to "gas-insulated equipment" (GIE) to clarify that more devices beyond switchgear are covered by the Regulation. This terminology change would not affect the types of devices covered under the Regulation, and the term GIE will be used throughout this document.

SF₆ is an extremely powerful and long-lived GHG. The 100-year global warming potential (GWP) of SF₆, which indicates its heat-absorbing ability relative to that of carbon dioxide (CO₂) over a 100-year period, is 22,800, making it the most

potent of the six main GHGs. Because of its extremely high GWP, small reductions in SF₆ emissions can have a large impact on reducing GHG emissions, which are the main drivers of climate change. The current Regulation requires reductions of SF₆ emissions from GIS over time, setting an annual emission rate limit that each GIE owner may not exceed. The maximum allowable emission rate started at ten percent in 2011, and has decreased one percent per year since then. In 2020, the limit reached one percent and without any changes to the current Regulation, the limit would remain at that level. Data reported under the Regulation show that statewide SF₆ capacity is growing by one to five percent per year, and projections provided by GIE owners indicate that this trend will continue into the future. Because, under the current Regulation, the emissions limit would remain equivalent to one percent of annual capacity, as capacity grows, so too would expected emissions.

The Legislature reaffirmed California's commitment to take further action against climate change by adopting Senate Bill (SB) 32 (Chapter 250, Statutes of 2016), which further directs the State to reduce its GHG emissions to at least 40 percent below the 1990 level by 2030. In 2019, CARB initiated a process to explore achievable paths toward carbon neutrality and is working to implement direction provided in Board Resolution 17-46 to evaluate and explore opportunities to achieve additional significant cuts in GHG emissions from all sources.

Considerable progress has been made in the past decade to develop non-SF₆ GIE; across the voltage spectrum, manufacturers now either offer market-ready non-SF₆ GIE or have development plans in the foreseeable future. Despite this progress, inventory data reported under the Regulation show that SF₆ capacity in the State has been growing, meaning that non-SF₆ technologies have not yet been widely adopted, and staff projects that SF₆ capacity will continue growing well into the future. This indicates that a regulatory change is necessary to drive the transition away from the use of SF₆ in GIE.

In response to California's aggressive climate goals and the increasing availability of technology that does not use SF₆, CARB staff is proposing to amend the Regulation to clarify regulatory coverage, expand the scope to include other GHGs beyond SF₆, drive GHG emissions reductions, accelerate the transition to technologies that do not use SF₆, improve the ability of equipment owners with relatively small amounts of SF₆ to comply with the Regulation, specify reporting and accounting procedures to increase reporting accuracy and facilitate tracking of GHGs covered under the proposed Regulation, and improve CARB staff's ability to verify reported data.

Due to the expansion in the Regulation's scope to include other GHGs beyond SF₆, and the terminology change from GIS to GIE, CARB staff is proposing to change the name of the Regulation to the "Regulation for Reducing Greenhouse Gas Emissions from Gas Insulated Equipment." If enacted, the

amendments will go into effect following the schedule described in the Proposed Regulation Order. Some changes will become effective the day the Regulation is finalized and will impact each GIE owner's data year¹ 2021 annual report (due June 1, 2022). Other changes that require new data to be collected will become effective January 1, 2022, or after.

Objectives and Benefits of the Proposed Regulatory Action:

The proposed Regulation would establish a timeline for phasing out acquisition of SF₆ GIE in California that would take effect in stages between 2025 and 2033. The proposed amendments would reduce total GHG emissions from GIE, improve the ability of small GIE owners to comply, improve accuracy in reported emissions, and improve CARB staff's ability to verify reported data. The proposed Regulation has been developed with the help of a robust informal public process, which included three publicly noticed workshops and one publicly noticed working group meeting from November 2017 through August 2019. The proposed amendments would:

- Expand the scope of the Regulation to cover emissions of all insulating gases with a global warming potential (GWP) greater than one, and clarify terminology related to which GIE are covered by the Regulation;
- Establish a timeline for phasing out acquisition of SF₆ GIE in California and create an incentive to encourage GIE owners to acquire non-SF₆ GIE prior to the phaseout;
- Establish a failure notification and a phase-out exemption request process through which GIE owners could acquire SF₆ GIE after the phase-out when certain conditions are met;
- Establish alternative emissions limits for small-capacity GIE owners to improve their ability to comply with the Regulation, assign each GIE owner an emissions limit in metric tons of CO₂ equivalent (MTCO₂e) (as opposed to the current SF₆-specific emission rate limit), and establish methods to minimize the growth of the emissions limit over time;
- Revise reporting requirements to improve reporting accuracy, clarify requirements, close gaps in accounting for SF₆ and other covered insulated gases, and improve CARB staff's ability to verify reported data; and
- Add an optional process to correct the nameplate capacity of existing GIE.

Staff analyzed the impacts of the amendments, in particular the installation of non-SF₆ GIE due to the phase-out, through 2036, one year after which all revisions in the proposed Regulation would come into effect. Absent the proposed amendments, staff estimates SF₆ emissions in 2036 to be 364,000 MTCO₂e, a significant increase relative to estimated emissions of 286,000

¹ "Data year" means the calendar year for which a GIE owner must submit an annual GHG emissions data report.

MTCO₂e in 2024, the year before the phase-out begins. By contrast, staff estimates the proposed Regulation will reduce the 2036 emissions level to be 284,000 MTCO₂e. Cumulative emissions reductions for the period 2021 to 2036 will be approximately 395,000 MTCO₂e. Because GIE lasts approximately 40 years, emissions reductions from non-SF₆ GIE acquired between 2025 and 2036 will continue through 2075, resulting in cumulative emissions reductions of approximately 3,147,000 MTCO₂e.

The proposed changes to the Regulation are explained here in further detail.

Expanding Scope and Clarifying Coverage of the Regulation

The purpose of the proposed Regulation is to further reduce emissions by phasing out SF₆ use so that GIE owners will transition to the use of non-SF₆ GIE, some of which may utilize GHGs other than SF₆ that have substantially lower GWPs than SF₆. The introduction of insulating gases that contain a GHG other than SF₆ necessitates expanding the scope of the Regulation to include GHGs with a GWP greater than one. Staff proposes only to require the reporting and regulatory coverage of insulating gases with a GWP greater than one because the amount of GHGs with GWPs less than or equal to one that would be used in GIE would have a relatively small potential impact to global warming (in MTCO₂e). This is because the volume of insulating gas with a GWP less than or equal to one contained in GIE through the State is anticipated to be very low. If all SF₆ in active, non-hermetically sealed GIE in California at present were converted to CO₂, the amount of CO₂ in GIE statewide would be about 1,000 MTCO₂e. Annual CO₂ emissions in this case would be roughly ten metric tons (assuming a one-percent leak rate as required by the Regulation), which is roughly equivalent to the emissions from driving two passenger vehicles for a year.²

Throughout the proposed Regulation and this document, the term “SF₆” was in many places replaced with “insulating gas with a GWP greater than one” or “covered insulating gas,” except in cases where specific references to SF₆ are still needed. Coverage of these alternative gases in the Regulation ensures continued tracking of GHGs from the operation of GIE in the state. It also facilitates recognition of the transition from SF₆ GIE to non-SF₆ GIE.

SF₆ Phase-Out and Early Action Credit

In Table 1 and Table 2 of the proposed Regulation, CARB staff proposes a schedule for the phase-out of the acquisition of new SF₆ GIE. The phase-out dates differ according to voltage capacity, short-circuit current rating, and configuration (i.e., above or below ground). Non-SF₆ GIE either do not contain a GHG or use insulating gas with a significantly lower GWP than SF₆, so the

² U.S. EPA Greenhouse Gas Equivalencies Calculator: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>. Last accessed November 20, 2019.

transition from SF₆ GIE to non-SF₆ GIE will have the benefit of reducing GHG emissions. In developing the phase-out schedule, CARB staff consulted with more than ten manufacturers currently developing non-SF₆ GIE to learn when their products are expected be commercially available. Additionally, based on stakeholder comments about the amount of time their organizations generally require to ensure that new products are safe, reliable, and deployable, CARB staff included a three-year period between expected commercial availability and proposed phase-out dates.

Because the phase-out dates would not begin until 2024, and certain types of non-SF₆ GIE are available now, the proposed regulatory amendments also include an early action credit. The early action credit would encourage GIE owners to place 72.5 kV or greater non-SF₆ circuit breakers into active service prior to the applicable phase-out date for those devices, which should lead to additional reductions in GHG emissions. The proposed credit is roughly equivalent to the amount of SF₆ in a comparable SF₆ circuit breaker.

SF₆ Notification and Phase-Out Exemption Process

As described above, CARB staff developed the phase-out schedule after discussing non-SF₆ GIE availability dates with over ten manufacturers for over a year. CARB staff, however, recognizes that, in some specific cases, GIE owners may need to install SF₆ GIE after the corresponding phase-out date.

Therefore, the proposed Regulation allows GIE owners to acquire SF₆ GIE after the applicable phase-out date under the following conditions: after a failure; when the GIE owner submits, and CARB approves, an SF₆ phase-out exemption request; when the SF₆ GIE device was present in the State for a prior data year; when the SF₆ GIE device was purchased prior to the applicable phase-out date (provided the SF₆ GIE device enters California no later than 24 months after the purchase date); or when the SF₆ GIE device is a replacement provided by the manufacturer under the terms of the manufacturer's warranty.

The Regulation outlines a notification process, whereby in response to a failure of a GIE device in active service, the GIE owner may acquire a replacement SF₆ device without prior approval from CARB. The GIE owner must notify CARB of the failure, then, once the replacement SF₆ device is acquired, provide additional information. To obtain a phase-out exemption, the GIE owner must submit a phase-out exemption request to CARB that would explain and justify the need for the exemption. If the request is approved, the GIE owner could acquire the SF₆ GIE described in the request and install the SF₆ GIE in the location(s) described in the exemption request.

Revisions to the Emission Rate Limit

The proposed Regulation contains revisions that would change the allowed emissions levels for GIE owners with smaller capacities of SF₆ and other covered insulating gases. As explained below, this change will enable small-capacity GIE owners to comply with the Regulation. Further, the proposed Regulation transitions the basis for evaluating emissions compliance from an emission rate limit to an emissions limit measured in MTCO₂e. The emissions limit will be structured to support the phase-out of SF₆, incentivize adoption of non-SF₆ GIE, and ensure continued emissions reductions despite the anticipated growth of GIE capacity in this sector.

a. Transition to an Annual Emissions Limit

The proposed Regulation includes a new method for GIE owners to calculate their emissions limit in terms of MTCO₂e rather than percent of average system capacity. From 2021³ through 2024, GIE owners with average system capacities of 10,000 MTCO₂e or greater will have an emissions limit equivalent to one percent of average system capacity (considering all insulating gases with a GWP greater than one), maintaining equivalency with the current Regulation.

The proposed Regulation increases the emissions limits for the smallest GIE owners. CARB staff's goal for the proposed Regulation was to set emission limits such that GIE owners of all sizes would be held to stringent but reasonable limits on emissions. Given the difficulty in achieving a one-percent emission rate for GIE owners with average system capacities below 10,000 MTCO₂e, and the fact that these owners make up less than two percent of statewide SF₆ capacity, staff proposes a threshold of 10,000 MTCO₂e, below which the emissions limit would be set at the equivalent of two percent of average system capacity from 2021 to 2034, or 50 MTCO₂e, whichever is greater.

b. Establishing a Baseline to Incentivize Adoption of Non-SF₆ GIE and Emissions Limit Stepdown

Because smaller capacities of SF₆ and other covered insulating gases can make compliance with the emissions limit more challenging, staff was concerned that establishing an emissions limit that is equivalent to one or two percent of active, non-hermetically sealed system capacity could actually disincentivize the replacement of SF₆ GIE with non-SF₆ GIE. That is, GIE owners may keep and operate their SF₆ GIE longer to maintain a higher capacity level. To address this issue, the proposed Regulation includes a baseline approach to provide GIE owners with adequate incentives to install non-SF₆ GIE whenever possible.

³ For data year 2021 only, the emissions limit considers SF₆ only. See the discussion in section III of the [ISOR](#), Rationale for Section 95353(b)(1).

An emissions limit with a baseline would incentivize a GIE owner to replace SF₆ GIE with non-SF₆ GIE after the baseline is set because the installation of non-SF₆ GIE would decrease the actual amount of SF₆ in their system, which would reduce the risk of SF₆ emissions, without any corresponding decrease in average system capacity used to evaluate regulatory compliance. This transition from SF₆ GIE to non-SF₆ GIE should result in additional reductions in GHG emissions. In addition, the baseline calculation includes early action credit whereby GIE owners that install qualifying non-SF₆ GIE in advance of the applicable phase-out date will receive an early action credit that can be added to the GIE owner's baseline.

Because system capacity on which the emissions limit will be based will not decrease when SF₆ GIE are replaced with non-SF₆ GIE, and because that capacity can grow with early action credit, the equivalent allowed emission rate will effectively grow over time, making it easier to comply with the Regulation. To ensure that the Regulation remains equally ambitious over time, CARB staff proposes that, in 2035, each GIE owner's emissions limit will be reduced by five percent, and remain at that level going forward, to maintain an effective emission rate limit near one or two percent.

Nameplate Capacity Adjustments

GIE owners have demonstrated that the SF₆ capacity of a device, as listed on the nameplate, may be incorrect. This is an issue because nameplate capacity is one of the terms used in the equation to calculate emissions, by which compliance with the regulation is determined. To address this issue, an optional process was added to the Regulation that allows GIE owners to determine a revised nameplate capacity for existing GIE by adding covered insulating gas until the design operating pressure specified by the manufacturer is reached, then measuring the amount of gas in the device.

Changes to Required Procedures and Reported Elements

Finally, the proposed Regulation contains revisions that would change reporting requirements to improve reporting accuracy, clarify requirements, close gaps in accounting for SF₆ and other covered insulated gases, and improve CARB staff's ability to verify reported data.

Benefits of Proposed Amendments

In total, the staff proposal achieves the following outcomes:

- Establishes an SF₆ phase-out schedule with unique dates for nine GIE categories, based on GIE voltage capacity, short-circuit current rating, and whether the GIE would be used above or below ground. The schedule is consistent with expected non-SF₆ product availability from at least two

manufacturers in each of those categories, and the phase-out dates are set to be three years after this availability. These factors are responsive to stakeholder feedback that non-SF₆ GIE must be available from more than one manufacturer and that GIE owners need approximately three years to familiarize themselves with the new GIE in advance of the phase-out dates. For non-SF₆ GIE that are available today, CARB staff set the earliest phase-out date to be 2025 to accommodate the three- to five-year capital planning cycle that GIE owners indicated they undertake.

- Includes an SF₆ phase-out exemption request process that offers GIE owners flexibility to acquire SF₆ GIE after the phase-out when non-SF₆ GIE are unavailable from at least two suppliers, and when available non-SF₆ GIE either cannot meet the size requirements, cannot be used due to incompatibility with existing infrastructure, or are not suitable based on safety or reliability requirements. In response to stakeholder feedback, a notification process allows GIE owners to install SF₆ GIE in the wake of a failure. This process allows GIE owners to quickly resolve a failure such that electricity system reliability can be maintained.
- Establishes early action credit. In recognition of stakeholder feedback and the fact that non-SF₆ GIE are available for some applications today, GIE owners that install qualifying non-SF₆ GIE in advance of the applicable phase-out date will receive an early action credit that can be added to the GIE owner's baseline. By being early adopters of non-SF₆ GIE, GIE owners will gain more experience with them, smoothing the transition to non-SF₆ GIE.
- Establishes emissions limits that all GIE owners can meet, regardless of their average system capacity. The emissions limits for GIE owners with average system capacity of less than 10,000 MTCO₂e will have an emissions limit equivalent to two-percent of their average system capacity, rather than having to meet the one-percent limit specified in the current Regulation. GIE owners of this size have demonstrated the difficulties they face in achieving a one-percent emission rate on an annual basis, and this adjustment allows them to maintain their 2019 allowed emission rate.
- Promotes accurate accounting of GHG emissions from GIE throughout the State by adding an alternative process to revise GIE nameplate capacity and expanding the current Regulation to cover additional GHGs expected to be used as insulating gases in GIE in the coming years. Other revisions to the reporting requirements will improve CARB staff's ability to verify the reported values.

Description of Regulatory Action

On July 21, 2020, CARB released the Notice of Public Hearing (45-Day Notice)⁴ and Staff Report: Initial Statement of Reasons for Rulemaking (Staff Report), titled "Public Hearing to Consider the Proposed Amendments to the Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear," for public review. The Staff Report contains a description of the rationale for the proposed amendments. On July 21, 2020, all references relied upon and identified in the Staff Report were made available to the public. CARB received written comments from twenty commenters during the 45-Day Notice comment period and one shortly thereafter.

On September 24, 2020, CARB conducted a public hearing. CARB staff informed the Board of the proposed amendments to the Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear and the Board received written and oral comments from the public. At the conclusion of the hearing, the Board approved Resolution 20-28 for adoption of the proposed amendments.

In accordance with Government Code section 11346.8, the Board directed the Executive Officer to adopt the proposed amendments after making any appropriate conforming modifications, as well as any additional supporting documents and information, available to the public for a period of at least 15 days. The Board further provided that the Executive Officer shall consider such written comments as may be submitted during this period, shall make such modifications as may be appropriate in light of the comments received, and shall present the regulations to the Board for further consideration if warranted.

Subsequent to the hearing, CARB released a Notice of Public Availability of Modified Text and Availability of Additional Documents and Information (15-Day Notice)⁵ on May 5, 2021. CARB released a Second Notice of Public Availability of Modified Text and Availability of Additional Documents and Information (second 15-Day Notice) on June 17, 2021. The text of the proposed regulatory and staff report modifications were posted on CARB's website at <https://ww2.arb.ca.gov/rulemaking/2020/sf6>, accessible to all stakeholders and interested parties.

⁴ This term derives from the Administrative Procedure Act, which specifies that originally-released regulatory text must be made available to the public for at least 45 days of review. (Cal. Gov. Code § 11346.4.) The actual duration of the comment period was 60 days.

⁵ This term derives from the Administrative Procedure Act, which specifies that proposed changes from the originally-released regulatory text must be made available to the public for at least 15 days of review. (Cal. Gov. Code § 11346.8(c).) The actual duration of the comment period was 21 days.

Comparable Federal Regulations:

In 2019, four of the GIE owners subject to the Regulation also filed an emissions report to United States Environmental Protection Agency (U.S. EPA) under 40 CFR Part 98 (Greenhouse Gas Reporting Program or GHGRP) Subpart DD.⁶ U.S. EPA's GHGRP requires reporting of GHG emissions data and other relevant information from GIE owners whose aggregate nameplate capacity of non-hermetically sealed GIE exceed 17,820 pounds of SF₆ or perfluorinated compounds.⁷ U.S. EPA states that these data can be used by businesses and others to track and compare facilities' GHG emissions and identify opportunities to reduce pollution, minimize wasted energy, and save money.⁸ U.S. EPA's GHGRP does not require that emissions be reduced; it only requires that they be reported. This stands in contrast to CARB's Regulation, which was enacted as an early action measure under AB 32 for the purpose of achieving GHG emissions reductions. As such, more granular data are required to be reported under CARB's Regulation, which requires that all GIE owners in California report emissions and ensure that they do not exceed the applicable emissions limit.

U.S. EPA's GHGRP is not a comparable federal regulation because it has a high reporting threshold and lacks any emissions limit. CARB's Regulation is needed to support mandated GHG emissions reductions, as set by SB 32, and follow the direction provided in Board Resolution 17-46 to evaluate and explore opportunities to achieve additional significant cuts in GHG emissions from all sources.

An Evaluation of Inconsistency or Incompatibility with Existing State Regulations (Gov. Code, § 11346.5, subd. (a)(3)(D)):

During the process of developing the proposed regulatory action, CARB conducted a search of any similar regulations on this topic and concluded the proposed regulation is neither inconsistent nor incompatible with existing State regulations.

⁶ U.S. EPA Greenhouse Gas Reporting Program data, accessed through FLIGHT: <https://go.usa.gov/xFxJt>

⁷ Subpart DD, Greenhouse Gas Reporting Program – Electric Transmission and Distribution Equipment Use: https://www.epa.gov/sites/production/files/2018-02/documents/dd_infosheet_2018.pdf

⁸ Greenhouse Gas Reporting Program (GHGRP): <https://www.epa.gov/ghgreporting/learn-about-greenhouse-gas-reporting-program-ghgrp>